



6021

## MEDIUM-MU TWIN TRIODE

SUBMINIATURE TYPE

6021  
PREMIUM TYPE

Intended for applications at altitudes up to 60,000 feet where dependable performance under shock and vibration is paramount

## GENERAL DATA

## Electrical:

Heater, Pure Tungsten, for Unipotential Cathodes:

Voltage. . . . . 6.3 . . . . . ac or dc volts

Current. . . . . 0.3 . . . . . amp

Direct Interelectrode Capacitances:

	Without External Shield	With External Shield <sup>0</sup>	
Grid to plate (Each unit). . .	1.5	1.4	$\mu\text{f}$
Grid to cathode and heater (Each unit). . . . .	2.4	2.1	$\mu\text{f}$
Plate to cathode and heater (Unit No.1). . . . .	0.28	1.3	$\mu\text{f}$
Plate to cathode and heater (Unit No.2). . . . .	0.32	1.4	$\mu\text{f}$
Grid to grid . . . . .	0.013 max.	0.011 max.	$\mu\text{f}$
Plate to plate . . . . .	0.52 max.	0.33 max.	$\mu\text{f}$

Characteristics, Class A<sub>1</sub> Amplifier (Each Unit):

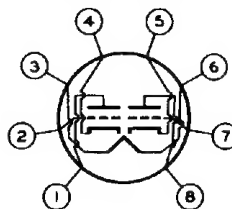
Plate-Supply Voltage . . . . .	100	volts
Cathode Resistor . . . . .	150	ohms
Amplification Factor . . . . .	35	
Plate Resistance (Approx.) . . . . .	6500	ohms
Transconductance . . . . .	5400	$\mu\text{mhos}$
Plate Current. . . . .	6.5	ma
Grid Voltage (Approx.) for plate current of 10 $\mu\text{a}$ . . . . .	-6.5	volts

## Mechanical:

Operating Position . . . . .	Any
Maximum Length (Excluding flexible leads). . . . .	1-3/8"
Length, Bulb Seat to Bulb Top (Excluding tip). . . . .	1.075" $\pm$ 0.060"
Diameter . . . . .	0.366" to 0.400"
Dimensional Outline. . . . .	See General Section
Bulb . . . . .	T3
Leads, Flexible. . . . .	8
Length . . . . .	1-1/2" to 1-3/4"
Orientation and diameter . . . . .	See Dimensional Outline

## BOTTOM VIEW

Lead 1 - Plate of  
Unit No.2  
Lead 2 - Grid of  
Unit No.2  
Lead 3 - Heater  
Lead 4 - Cathode of  
Unit No.2



Lead 5 - Cathode of  
Unit No.1  
Lead 6 - Heater  
Lead 7 - Grid of  
Unit No.1  
Lead 8 - Plate of  
Unit No.1

<sup>0</sup>: See next page.

4-58

ELECTRON TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1

6021



6021

# MEDIUM-MU TWIN TRIODE

## AMPLIFIER — Class A<sub>1</sub>

Values are for Each Unit

### Maximum Ratings, Absolute Values:

For Operation at Altitudes up to 60,000 Feet

PLATE VOLTAGE. . . . .	165 max.	volts
GRID VOLTAGE:		
Positive bias value. . . . .	0 max.	volts
Negative bias value. . . . .	55 max.	volts
PLATE CURRENT. . . . .	22 max.	ma
GRID CURRENT. . . . .	5.5 max.	ma
PLATE DISSIPATION. . . . .	1.1 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. . .	200 max.	volts
Heater positive with respect to cathode. . .	200 max.	volts
BULB TEMPERATURE (At hottest point		
on bulb surface) . . . . .	220 max.	°C

### Maximum Circuit Values:

Grid-Circuit Resistance:

For cathode-bias operation . . . . . 1.1 max. megohms

<sup>o</sup> With external shield having inside diameter of 0.405" connected to cathode of unit under test.

### CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are for Each Unit (Other unit connected to ground)  
and are Initial, Unless Otherwise Indicated

	Note	Min.	Max.	
Heater Current . . . . .	1	0.28	0.32	amp
Heater Current at				
500 hours. . . . .	1	0.276	0.328	amp
Direct Interelectrode				
Capacitances:				
Grid to plate. . . . .	2	1.2	1.8	μf
Grid to cathode and				
heater . . . . .	2	1.8	3	μf
Plate to cathode and				
heater (Unit No.1) . .	2	0.2	0.36	μf
Plate to cathode and				
heater (Unit No.2) . .	2	0.22	0.42	μf
Grid to grid . . . . .	3	—	0.013	μf
Plate to plate . . . . .	3	—	0.52	μf
Amplification Factor . . .	1,4	30	40	
Plate Current (1). . . . .	1,4	4.5	8.5	ma
Plate-Current Difference				
Between Units. . . . .	1,4	—	1.6	ma
Plate Current (2). . . . .	1,5	—	100	μa
Transconductance (1) . . .	1,4	4450	6350	μmhos

Notes 1 to 5: See next page.



6021

6021

## MEDIUM-MU TWIN TRIODE

	Note	Min.	Max.	
Transconductance (1) Change:				
With heater voltage				
reduced to 5.7 volts. .	4	-	15	%
Individual at 500 hours .	1,4	-	25	%
Average at 500 hours. . .	1,4	-	15	%
Average at 500 hours:				
With heater voltage				
reduced to 5.7 volts. .	4	-	15	%
Reverse Grid Current. . . .	1,6	-	0.3	$\mu$ a
Reverse Grid Current at				
500 hours . . . . .	1,6	-	0.9	$\mu$ a
Grid Emission Current . . .	7	-	-0.5	$\mu$ a
Heater-Cathode Leakage				
Current:				
Heater 100 volts negative				
with respect to cathode.	1	-	5	$\mu$ a
Heater 100 volts positive				
with respect to cathode.	1	-	5	$\mu$ a
Heater-Cathode Leakage				
Current at 500 hours:				
Heater 100 volts negative				
with respect to cathode.	1	-	10	$\mu$ a
Heater 100 volts positive				
with respect to cathode.	1	-	10	$\mu$ a
Leakage Resistance:				
Between grid and all				
other electrodes tied				
together. . . . .	1,3,8	100	-	megohms
Between plate and all				
other electrodes tied				
together. . . . .	1,3,9	100	-	megohms
Leakage Resistance at				
500 hours:				
Between grid and all				
other electrodes tied				
together. . . . .	1,3,8	50	-	megohms
Between plate and all				
other electrodes tied				
together. . . . .	1,3,9	50	-	megohms
Note 1: With 6.3 volts ac or dc on heater.				
Note 2: Without external shield.				
Note 3: Other electrodes connected to ground.				
Note 4: With dc plate-supply voltage of 100 volts, cathode resistor of 150 ohms, and cathode-resistor bypass capacitor of 1000 $\mu$ f.				
Note 5: With dc plate voltage of 100 volts and grid voltage of -6.5 volts.				
Note 6: With dc plate-supply voltage of 150 volts, cathode resistor of 300 ohms, and grid resistor of 1 megohm.				
Note 7: With ac or dc heater voltage of 7.5 volts, dc plate voltage of 150 volts, grid voltage of -7.5 volts, and grid resistor of 1 megohm.				
Note 8: With grid voltage of -100 volts.				
Note 9: With dc plate voltage of -300 volts.				

6021



6021

## MEDIUM-MU TWIN TRIODE

### SPECIAL RATINGS AND PERFORMANCE DATA

#### Shock Rating:

Impact Acceleration . . . . . 450 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are tested in four different positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

#### Fatigue Ratings:

Vibrational Acceleration . . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 60 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

#### Variable-Frequency Vibration Performance:

This test is performed on a sample lot from each production run. Tubes are vibrated over the frequency range of 5 to 50 cps at a total excursion of 0.08" for 3 minutes. At the end of this test, tubes are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

#### Low-Frequency Vibration Performance:

RMS Output Voltage . . . . . 50 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate-supply voltage of 100 volts, cathode resistor of 150 ohms, plate load resistor of 10000 ohms and vibrational acceleration of 15 g at 40 cps.

#### Heater-Cycling Life Performance:

Cycles of Intermittent Operation . . . . 2000 min. cycles

Under the following conditions: Heater voltage of 7.0 volts cycled one minute on and four minutes off, heater 140 volts rms with respect to both cathodes tied together.

#### Audio-Frequency Noise and Microphonic Performance:

RMS Output Voltage . . . . . 65 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate-supply voltage of 100 volts, cathode resistor of 75 ohms, grid-No.1 resistor of 0.1



6021

6021

## MEDIUM-MU TWIN TRIODE

megohm, plate load resistor of 0.01 megohm, and cathode-bypass capacitor of 1000  $\mu$ f. Units are connected in parallel. The output voltage of a tube, when tapped, will not cause a reading on a vu meter greater than that produced when a calibrating signal of 65 millivolts rms is applied to the plates of the tube.

### Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is considered inoperative if it shows a permanent or temporary short or open circuit, or a value of reverse grid current in excess of 1.0 microampere under the conditions specified in the Characteristics Range Values for reverse grid current.

### 1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Conditions of life testing are specified under 500-Hour Intermittent Life Performance, except test run at room temperature. Tubes are initially read for transconductance (1). At the end of 1 hour, the value of transconductance (1) is read. The variation in transconductance (1) from the 0-hour reading will not exceed 15 per cent under the conditions specified in Characteristics Range Values.

### 100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Conditions of life testing are specified under 500-Hour Intermittent Life Performance, except test run at room temperature. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, reverse grid current in excess of 1.0 microampere, or a transconductance (1) of less than 4000 micromhos under the conditions specified in Characteristics Range Values.

### 500-Hour Intermittent Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. Life testing is conducted under the following conditions: Heater voltage of 6.3 volts, plate-supply voltage of 100 volts, heater-cathode voltage of 200 volts (heater positive with respect to cathode), cathode resistor of 150 ohms, grid resistor of 1 megohm and bulb temperature of 220° C. At the end of 500 hours, tube will not show permanent shorts or open circuits and will be criticized for the total number of

6021



6021

## MEDIUM-MU TWIN TRIODE

defects in the sample lot and for the number of tubes failing to pass established initial limits of heater current, individual, average, and 5.7-heater-voltage transconductance change, reverse grid current and heater-cathode leakage current shown under Characteristics Range Values.

### OPERATING CONSIDERATIONS

The *heater supply* should be well regulated because life and reliability of the 6021 are adversely affected by departures from the 6.3-volt value. The extent to which life is affected is a function of the amount of these departures and their durations.

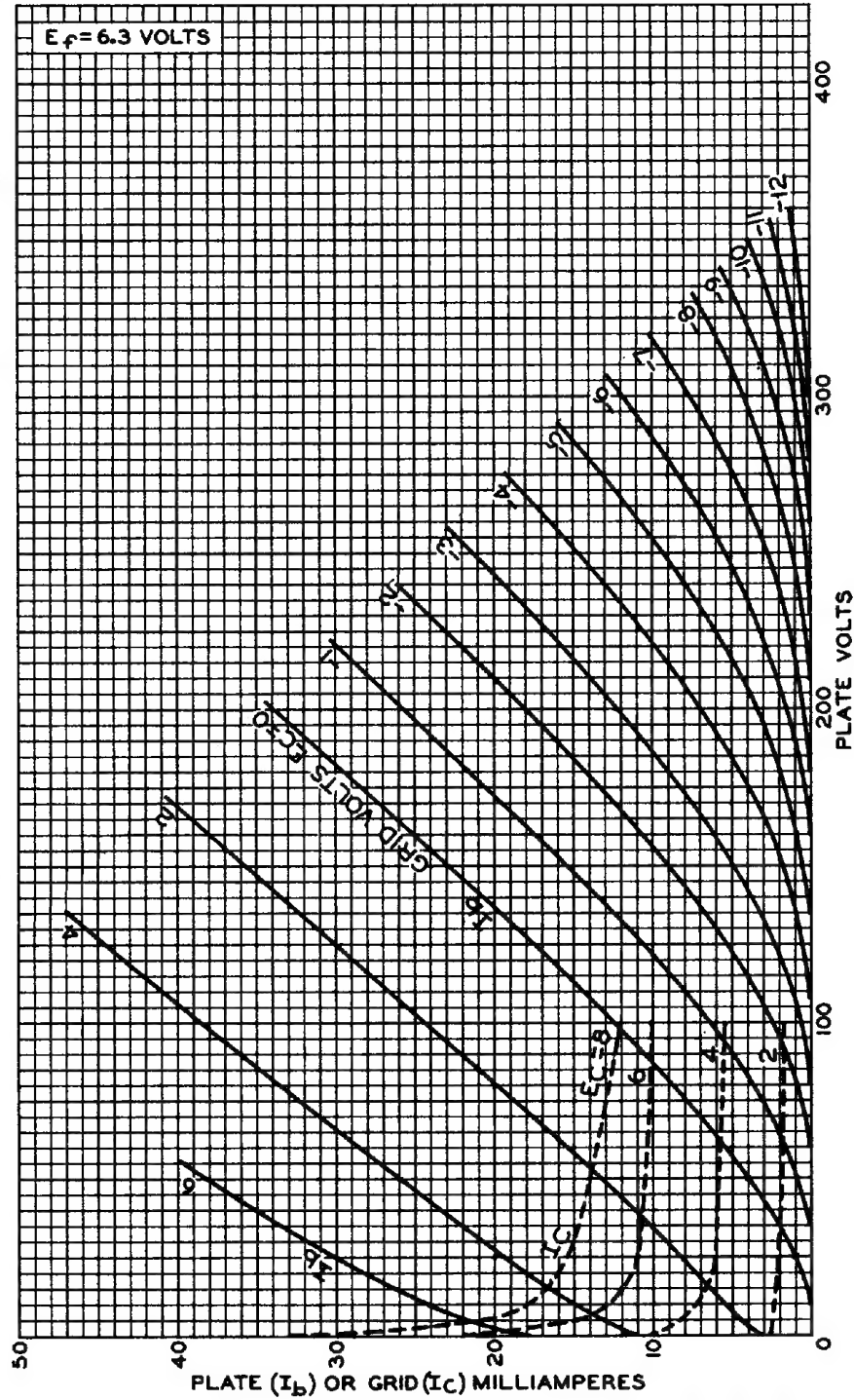
The *flexible leads* of the 6021 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering operation may crack the glass seals of the leads and damage the tube.



6021

# AVERAGE CHARACTERISTICS EACH UNIT

6021



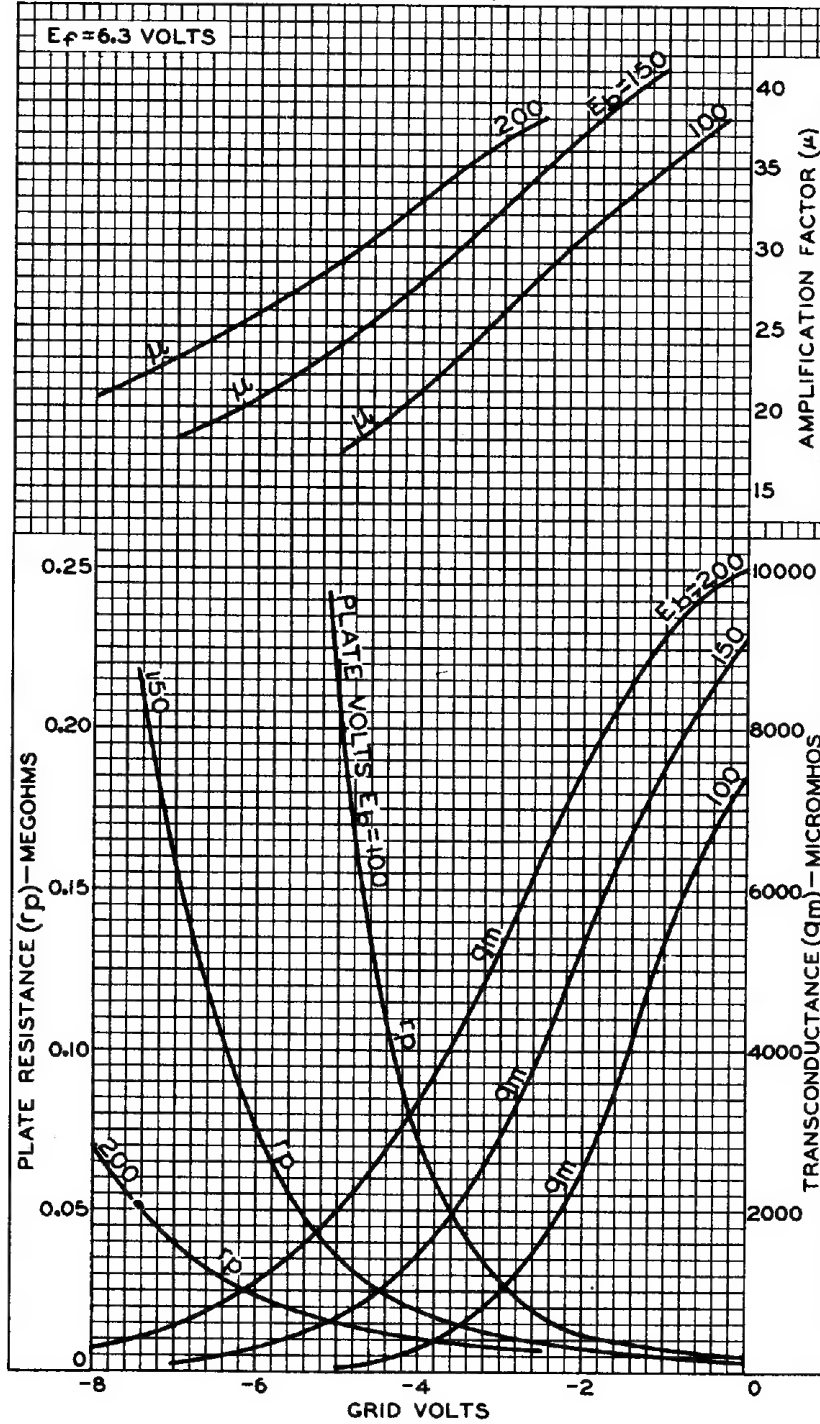
ELECTRON TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9439

6021



6021

AVERAGE CHARACTERISTICS  
EACH UNITELECTRON TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9440